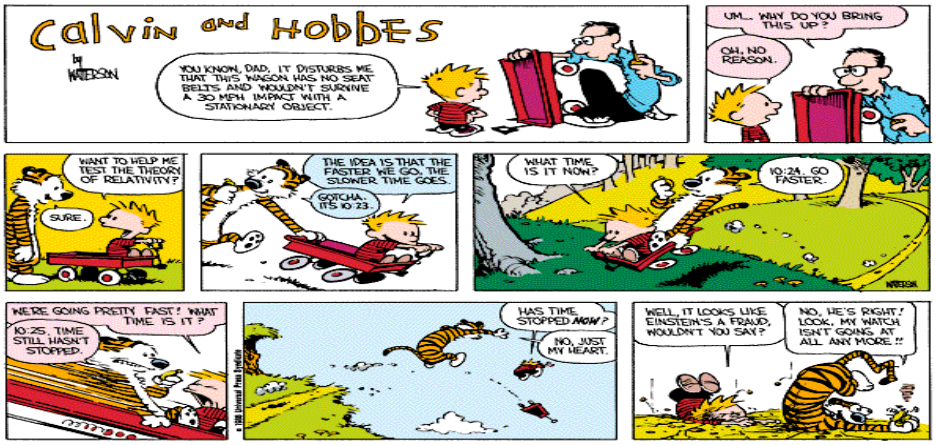
Eaglet Science

November 2009



A Monthly Newsletter for the Parents of Ridgewood Prep Middle School Students

Since the beginning of the year, your students have been taught a variety of subjects. The 7th grade classes have been learning about cells, genetics, heredity, DNA, and using Microscopes. The 8th grade classes have been learning about light, speed and acceleration, motion, momentum, and force.

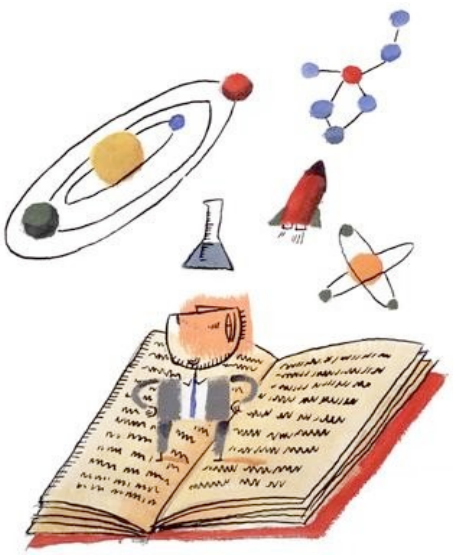
About the Teachers

7th

Lisa Hartman is the 7th grade science teacher. Ms. Hartman is Louisiana's State Finalist in science for the Presidential Awards for Excellence in Mathematics and Science Teaching.

8th

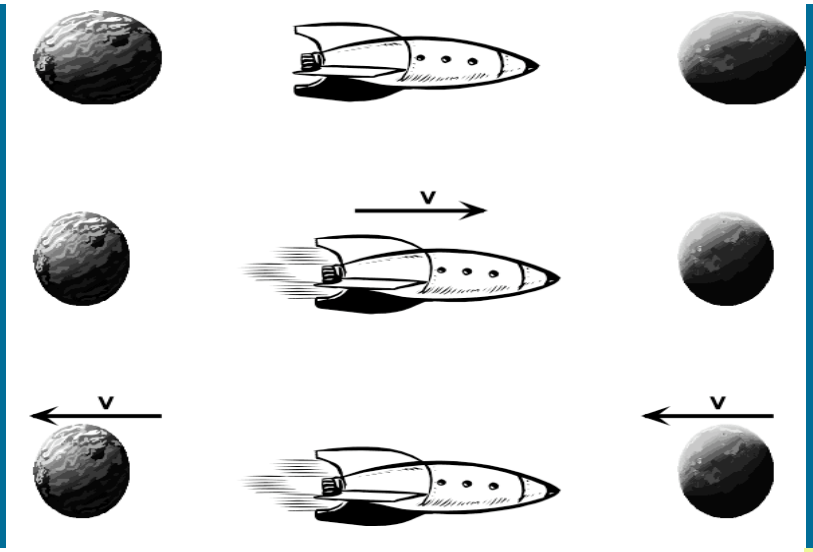
Callie Gibson is the 8th grade science teacher. She discovered her love of science in a class called Scientific Inquiry her sophomore year of college. She is very excited about the rest of the year!



This month the 8th graders will begin a survey of Einstein's theory of special relativity.

imagination is more important than knowledge. knowledge is limited. imagination encircles the world.—albert einstein

Many of you may wonder why I have chosen to teach middle school students about relativity. It is a subject tackled by college students and professors, not children. However, I believe that a foundation must be laid early in life. A comprehensive education is necessary for reading the newspaper, watching the news, and being a global citizen. As 8th graders, these kids are getting ready to enter high school, where they will take a series of science classes, including physics. I have chosen relativity not only for its content but also for its great thinker. Albert Einstein was one of the most influential characters in science and he was an amazing scholar. No, he does not have the reputation as a great student. Einstein was always eager to learn. (Don't worry: We will be teaching your students in the more conventional sense of learning.) Einstein kept learning no matter what age he was. It is okay to stray from the pack and be one's own self. I think these are important lessons to learn before entering high school. Relativity is also important because it shows students that science can be as interesting as the books they read or the movies they watch. It can be more than just boring measurements. It can boggle the mind and inspire imagination. That is my goal.



Why special relativity?

Callie Gibson

The week of lessons on relativity will cover special relativity. The first lesson will only cover the basics for what we will be learning over the next week. Einstein himself began thinking about light traveling at a very early age. James Clerk Maxwell had a set of 8 equations that formed the basis of time-space. Einstein looked at these laws as a 16-year-old boy and wondered what it would be like to ride alongside a light wave, trying to catch up. I do think that some of the math and equations will be a little out of the league for your students, so we will not be going as far back as Maxwell's equations. It is important to plant these seeds early on though. The topic will be taught with less depth than would be normal in a high school Physics class, but no less remarkably. It is truly one of the pieces of mind-blowing science, which many students will find inspirational.

True, not all topics are equally inspiring for all students. There are students who find using a balance beam fascinating and others who want to move on. We will spend no less time on the other subjects outlined on the syllabus. Relativity will not be a main portion of any test. I do not expect all of the students to fully understand. It will be laid out very simply and they will be expected to remember the main points. Even superficial exposure will help discover a passion for science that could last a lifetime.

Einstein had two theories of relativity—special and general. The theories require that the laws of physics remain true in all frames of reference. Frames of reference are singular to an individual. Essential to understanding relativity is a basic understanding of mass, energy, and light. This is why this month is the ideal time to begin studying relativity. We have already spent a considerable amount of time studying the basics. We will be focusing on Special Relativity in this first class.

Special Relativity describes the motion of things moving close to the speed of light. It only deals with situations in which motion is constant and gravity is not taken into account. In special relativity, there are two postulates to remember. 1) All motion must be considered relative to some frame of reference chosen based on the individual. There is no privileged frame of reference though. 2) The speed of light is constant in ALL conditions. Nothing can go faster than the speed of light.

General Relativity does include gravity. It combines the special relativity and Newton's law of universal gravitation. Gravity is described as a geometric property of space and time. I will not be teaching general relativity in these classes. The math needed would be several forms of non-Euclidean geometry. If I taught general relativity, I would confuse them a bit much before they were able to take geometry as a math.

Isaac Newton described gravity as acting instantaneously on an object, but nothing can go faster than the speed of light. However, Newton's Laws of Inertia are very applicable here, but Newton's laws provide the form for things moving at very slow speeds, much slower than the speed of light. Special Relativity is counterintuitive which makes it more difficult to explain. However, anyone wishing to describe relativity must first be

> "found sheer beauty and creative joy in science and equations. If only we could convey that in the way we teach science and math, maybe we could nurture another Einstein"

able to understand how events can be described differently from two different frames of reference. For instance, take Einstein's famous train example. A passenger on a train has a different perspective than a person on the platform. Motion is perceived differently from the train because the person in the train feels at rest than it is for the person on the platform who considers the person on the train as moving because the train is moving. If a person is traveling at the speed of light, he will see the world in a very different way than people who are standing still do.

In the first discussion, we will be discussing the two postulates mentioned earlier and attempt some examples. If we have time, we will also discuss time dilation. Then we will move on to mass and length contraction. None of these kids have a focus on science and they have never heard of relativity. It is essential that we teach the techniques regarding frames of reference by applying the techniques to entirely commonplace, intuitive examples, like cars, trains, baseballs, and trucks. We will even address rocket ships.

This scene from Alice in Wonderland illustrates many opinions of relativity. It is considered a waste of time or an impossible riddle. However, it is my personal opinion that by beginning to teach relativity at an early age, students can understand more each and every time they talk about it. I believe in universal learning where the lessons are reinforced at home. There is only so much we can do in the classroom. I am including a website that I would recommend you visiting with your student to supplement what they will be learning.

"Have you guessed the riddle yet?" the Hatter said, turning to Alice again.

"No, I give it up," Alice replied: "what's the answer?"

"I haven't the slightest idea," said the Hatter.

"Nor I," said the March Hare.

Alice sighed wearily. "I think you might do something better with the time," she said, "than wasting it in asking riddles that have no answers."

The toughest aspects to accept will probably be the ramifications of the constancy of the speed of light. If the speed of light is constant, then distance and time are changeable. The equation showing this is $t = t'/(\sqrt{1-(v^2/c^2)})$. The old time (t) is related to the new time (t'). Relativity talks about when the velocity is very large, as close to the speed of light (c) as possible. When the velocity is very large then time appears to slow down. This will be very hard to accept because it is counterintuitive. However, we will apply this facet of special relativity to known objects with known behaviors. This will make accepting special relativity easier.

We always wonder how education will translate into a student's life. These subjects are something beyond normal thought. However, today's pop culture includes many things that can be enhanced by a superficial understanding of relativity. Movies and books that have previously been only entertaining can now be jumping points for discussion and imagination. A society not stimulating imagination when it comes to science and math won't produce many Einsteins.

There are many examples in movies and books that apply to aspects of relativity. In special relativity, there are no simultaneous events. Everything when viewed from different frames of reference is seen as different times. Take for instance Hermione's Time Turner in the Harry Potter series. Hermione uses the Time Turner to go back in time to achieve her schedule of conflicting classes. When she goes back in time, her present self goes back in the past where she is the future. However, her past self does not see the simultaneous selves. In the Ender series by science fiction author Orson Scott Card, Ender is taken on a space ship to planet far away from Earth. His siblings on Earth age much faster than he does. His brother, who was only two years older than Ender on earth, dies at the age of 77 when Ender is about 17 or 18. Ender and all of humanity use the ansible for communication. It is a way of communication that travels near the speed of light. People can talk between ships that are across the galaxy from one another. Movies include Flight of the Navigator, Planet of the Apes, Close Encounters of the Third Kind, 2001: Space Odyssey, Clockstoppers. I am not personally recommending any of these movies. You may want to check ratings and reviews before watching these movies with your children.

Thinking Like Einstein http://www.exploratorium.edu/relativity/einstein.html
This takes you to the main page. There are five links at the top of the page. Click on the spaceship first and complete the activity. The other four links explain what is going on in the spaceship. Your students will really enjoy the activity. They will really be excited if they are able to teach you something about relativity!

Animalia: What does that include?

Lisa Hartman

As you read above, the 7th graders have been studying cells, DNA, heredity, and using microscopes. We will be moving on to Classification this month. We will begin with the basics of the Linnaean classification system. We will be studying several different organisms to try and classify them based on observation. The Linnaean system includes separating organisms based on observable characteristics.

Your students will be responsible for creating a classification key for a newly discovered planet. They receive a collection of cards and will be responsible for separating the cards into categories based on differing characteristics. The will receive an example in class.

We will then go in depth in each Kingdom beginning with Animalia. We will start with basic: sponges, worms, mollusks. Then we will move on to arthropods (spiders and crayfish) and insects.

There will be a couple of dissections but nothing more advanced than a frog. There will also be an insect collection project. Students will be responsible for collecting and identifying 30 insects. Supplies and further instructions will be provided.

We will study fish, amphibians, reptiles, birds and mammals. There is a possibility that we will dissect a cow eye while studying mammals.

There will be a field trip to the aquarium and the zoo during the month. If you are interested in chaperoning, please contact me.

There are several shows on PBS this month that I would recommend for the children to watch if they have the chance. “The Shape of Life” “Encountering Sea Monsters” “Silence of the Bees” “Penguins” “The Good, The Bad, and the Grizzly” “The Dolphin Defender” “The Gorilla King”

I do not expect the children to watch all of the shows, and students are not required to watch any of the shows. They simply supplement learning.

Upcoming Events

November 7
Honor Roll Release

November 10
Open House for Parents

November 17
7th Grade Field Trip to the Zoo

November 20
Parent/Teacher Conferences

November 25-27
Thanksgiving Holiday

December 12-15
8th Grade Science Fair

the most beautiful thing we can experience is the mysterious. it is the source of all true art and science.—albert einstein

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